

GARCH REGRESSION

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*           GARCH Model Fit           *
*-----*
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Conditional Variance Dynamics

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GARCH Model      : SGARCH(1,1)
Mean Model       : ARFIMA(0,0,0)
Distribution      : norm
```

Optimal Parameters

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      Estimate   Std. Error   t value   Pr(>|t|)
mu         0.154209    0.031257    4.9335    1e-06
omega      0.129162    0.026817    4.8165    1e-06
alpha1     0.096821    0.016613    5.8279    0e+00
beta1      0.865128    0.021229   40.7527    0e+00
```

Robust Standard Errors:

```
      Estimate   Std. Error   t value   Pr(>|t|)
mu         0.154209    0.033954    4.5417  0.000006
omega      0.129162    0.039433    3.2755  0.001055
alpha1     0.096821    0.027010    3.5847  0.000338
beta1      0.865128    0.031295   27.6442  0.000000
```

LogLikelihood : -4761.206

Information Criteria

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Akaike          3.8820
Bayes           3.8915
Shibata         3.8820
Hannan-Quinn    3.8855
```

Weighted Ljung-Box Test on Standardized Residuals

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                        statistic p-value
Lag[1]                  2.205   0.1376
Lag[2*(p+q)+(p+q)-1][2] 2.208   0.2305
Lag[4*(p+q)+(p+q)-1][5] 3.931   0.2628
d.o.f=0
H0 : No serial correlation
```

Weighted Ljung-Box Test on Standardized Squared Residuals

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-----
                        statistic p-value
Lag[1]                  0.02861  0.8657
Lag[2*(p+q)+(p+q)-1][5] 1.32414  0.7830
Lag[4*(p+q)+(p+q)-1][9] 2.58672  0.8247
d.o.f=2
```

Weighted ARCH LM Tests

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      Statistic Shape Scale P-Value
ARCH Lag[3]    0.2444 0.500 2.000 0.6210
ARCH Lag[5]    1.7734 1.440 1.667 0.5235
ARCH Lag[7]    2.0989 2.315 1.543 0.6964
```

Nyblom stability test

Joint Statistic: 1.3212

Individual Statistics:

mu 0.2547

omega 0.3185

alpha1 0.7806

beta1 0.6942

Asymptotic Critical values (10% 5% 1%)

Joint Statistic: 1.07 1.24 1.6

Individual Statistic: 0.35 0.47 0.75

Sign Bias Test

Sign Bias t-value prob sig
Sign Bias 1.1404 0.25423
Negative Sign Bias 1.2223 0.22171
Positive Sign Bias 0.3006 0.76377
Joint Effect 8.1282 0.04343 **

Adjusted Pearson Goodness-of-Fit Test:

group statistic p-value(g-1)
1 20 97.3 1.645e-12
2 30 103.7 2.504e-10
3 40 123.5 1.054e-10
4 50 133.5 9.447e-10

GJR-GARCH(1,1,1)

* GARCH Model Fit *

Conditional Variance Dynamics

GARCH Model : gjrGARCH(1,1)

Mean Model : ARFIMA(0,0,0)

Distribution : norm

Optimal Parameters

mu Estimate Std. Error t value Pr(>|t|)
mu 0.112929 0.030651 3.6843 0.000229
omega 0.166437 0.026579 6.2619 0.000000
alpha1 0.015151 0.010213 1.4835 0.137929
beta1 0.842624 0.019896 42.3509 0.000000
gamma1 0.185556 0.028572 6.4943 0.000000

Robust Standard Errors:

Estimate Std. Error t value Pr(>|t|)
mu 0.112929 0.032408 3.4846 0.000493
omega 0.166437 0.043491 3.8270 0.000130
alpha1 0.015151 0.013438 1.1275 0.259545
beta1 0.842624 0.031003 27.1792 0.000000
gamma1 0.185556 0.041693 4.4505 0.000009

LogLikelihood : -4721.669

Information Criteria

Akaike 3.8506
Bayes 3.8625
Shibata 3.8506
Hannan-Quinn 3.8549

Weighted Ljung-Box Test on Standardized Residuals

 statistic p-value
Lag[1] 4.020 0.04496
Lag[2*(p+q)+(p+q)-1] [2] 4.076 0.07193
Lag[4*(p+q)+(p+q)-1] [5] 5.683 0.10672
d.o.f=0
H0 : No serial correlation

Weighted Ljung-Box Test on Standardized Squared Residuals

 statistic p-value
Lag[1] 0.587 0.4436
Lag[2*(p+q)+(p+q)-1] [5] 1.670 0.6981
Lag[4*(p+q)+(p+q)-1] [9] 2.927 0.7710
d.o.f=2

Weighted ARCH LM Tests

 Statistic Shape Scale P-Value
ARCH Lag[3] 0.1507 0.500 2.000 0.6979
ARCH Lag[5] 1.4620 1.440 1.667 0.6024
ARCH Lag[7] 2.1711 2.315 1.543 0.6811

Nyblom stability test

Joint Statistic: 1.5216
Individual Statistics:
mu 0.6546
omega 0.6813
alpha1 1.1241
beta1 1.0152
gamma1 0.9167

Asymptotic Critical values (10% 5% 1%)

Joint Statistic: 1.28 1.47 1.88
Individual Statistic: 0.35 0.47 0.75

Sign Bias Test

 t-value prob sig
Sign Bias 1.2732 0.2031
Negative Sign Bias 0.4749 0.6349
Positive Sign Bias 0.3556 0.7222
Joint Effect 1.7985 0.6153

Adjusted Pearson Goodness-of-Fit Test:

group statistic p-value(g-1)

1	20	80.05	1.825e-09
2	30	96.76	3.207e-09
3	40	105.73	4.541e-08
4	50	117.53	1.471e-07

EGARCH(1,1,1)

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*-----*
*          GARCH Model Fit          *
*-----*

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Conditional Variance Dynamics

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GARCH Model      : eGARCH(1,1)
Mean Model       : ARFIMA(0,0,0)
Distribution      : norm

```

Optimal Parameters

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-----
      Estimate Std. Error  t value Pr(>|t|)
mu      0.116788   0.215664   0.54153 0.588144
omega    0.051492   0.030552   1.68542 0.091909
alpha1 -0.105097   0.023886  -4.39991 0.000011
beta1    0.956138   0.016640  57.46110 0.000000
gamma1   0.158414   0.021082   7.51411 0.000000

```

Robust Standard Errors:

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      Estimate Std. Error  t value Pr(>|t|)
mu      0.116788   1.777846   0.065691 0.947624
omega    0.051492   0.237203   0.217081 0.828145
alpha1 -0.105097   0.151832  -0.692194 0.488816
beta1    0.956138   0.117809   8.115996 0.000000
gamma1   0.158414   0.038735   4.089713 0.000043

```

LogLikelihood : -4717.545

Information Criteria

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Akaike          3.8473
Bayes           3.8591
Shibata         3.8473
Hannan-Quinn    3.8516

```

Weighted Ljung-Box Test on Standardized Residuals

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                        statistic p-value
Lag[1]                  3.183 0.07439
Lag[2*(p+q)+(p+q)-1][2] 3.191 0.12459
Lag[4*(p+q)+(p+q)-1][5] 4.868 0.16390
d.o.f=0
H0 : No serial correlation

```

Weighted Ljung-Box Test on Standardized Squared Residuals

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-----
                        statistic p-value
Lag[1]                  0.01288 0.9096

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Lag[2*(p+q)+(p+q)-1][5] 0.29560 0.9842
 Lag[4*(p+q)+(p+q)-1][9] 0.78789 0.9934
 d.o.f=2

Weighted ARCH LM Tests

	Statistic	Shape	Scale	P-value
ARCH Lag[3]	0.0456	0.500	2.000	0.8309
ARCH Lag[5]	0.2814	1.440	1.667	0.9452
ARCH Lag[7]	0.5479	2.315	1.543	0.9738

Nyblom stability test

Joint Statistic: 2.0742

Individual Statistics:

mu 0.22809

omega 0.59666

alpha1 0.17931

beta1 1.21821

gamma1 0.07057

Asymptotic Critical values (10% 5% 1%)

Joint Statistic: 1.28 1.47 1.88

Individual Statistic: 0.35 0.47 0.75

Sign Bias Test

	t-value	prob	sig
Sign Bias	1.2283	0.2194	
Negative Sign Bias	0.2288	0.8191	
Positive Sign Bias	0.8338	0.4045	
Joint Effect	2.3088	0.5108	

Adjusted Pearson Goodness-of-Fit Test:

group	statistic	p-value(g-1)
1 20	76.01	8.982e-09
2 30	98.96	1.435e-09
3 40	101.99	1.545e-07
4 50	110.32	1.273e-06

TGARCH(1,1)

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*-----*
*          GARCH Model Fit          *
*-----*
```

Conditional Variance Dynamics

GARCH Model : fGARCH(1,1)
 fGARCH Sub-Model : TGARCH
 Mean Model : ARFIMA(0,0,0)
 Distribution : norm

Optimal Parameters

	Estimate	Std. Error	t value	Pr(> t)
mu	0.108244	0.028497	3.7984	0.000146

omega	0.091899	0.014086	6.5243	0.000000
alpha1	0.102248	0.013435	7.6106	0.000000
beta1	0.869154	0.015908	54.6374	0.000000
eta11	0.669020	0.087711	7.6276	0.000000

Robust Standard Errors:

	Estimate	Std. Error	t value	Pr(> t)
mu	0.108244	0.032747	3.3055	0.000948
omega	0.091899	0.023729	3.8729	0.000108
alpha1	0.102248	0.019361	5.2812	0.000000
beta1	0.869154	0.024951	34.8338	0.000000
eta11	0.669020	0.114042	5.8664	0.000000

LogLikelihood : -4705.291

Information Criteria

Akaike	3.8373
Bayes	3.8491
Shibata	3.8373
Hannan-Quinn	3.8416

Weighted Ljung-Box Test on Standardized Residuals

	statistic	p-value
Lag[1]	3.852	0.04970
Lag[2*(p+q)+(p+q)-1][2]	3.903	0.08009
Lag[4*(p+q)+(p+q)-1][5]	5.435	0.12178

d.o.f=0
H0 : No serial correlation

Weighted Ljung-Box Test on Standardized Squared Residuals

	statistic	p-value
Lag[1]	0.2249	0.6353
Lag[2*(p+q)+(p+q)-1][5]	0.8256	0.8977
Lag[4*(p+q)+(p+q)-1][9]	1.5929	0.9476

d.o.f=2

Weighted ARCH LM Tests

	Statistic	Shape	Scale	P-value
ARCH Lag[3]	0.1210	0.500	2.000	0.7279
ARCH Lag[5]	0.6943	1.440	1.667	0.8252
ARCH Lag[7]	1.1503	2.315	1.543	0.8879

Nyblom stability test

Joint Statistic: 1.4671
Individual Statistics:

mu	0.37966
omega	0.56529
alpha1	0.96439
beta1	0.80399
eta11	0.07741

Asymptotic Critical Values (10% 5% 1%)

Joint Statistic:	1.28	1.47	1.88
Individual Statistic:	0.35	0.47	0.75

Sign Bias Test

	t-value	prob	sig
Sign Bias	0.8849	0.3763	
Negative Sign Bias	0.2301	0.8180	
Positive Sign Bias	0.3366	0.7364	
Joint Effect	0.8657	0.8337	

Adjusted Pearson Goodness-of-Fit Test:

	group	statistic	p-value(g-1)
1	20	72.57	3.424e-08
2	30	86.59	1.207e-07
3	40	97.33	6.855e-07
4	50	111.46	9.099e-07